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ABSTRACT

An acoustic study of German focused on voice frequency at sentence-, turn-, and discourse-end in conversations. The data were drawn from short dialogues in which the same word occurs at the ends of utterances, in the middle of a turn, at the end of a turn, and at the end of a discourse. The dialogues were read 10 times by a male and a female native speaker of German. Peak frequency, endpoint frequency, and the degree of the fall in frequency were computed. Results indicate that peak frequencies tend to vary greatly, while endpoint frequencies do not. Discourse-final frequency is characterized by a lower peak and smaller degree of fall, but not significantly lower frequency. In addition, the data show that the male speaker uses more sharply falling contours at turn-ends than the female speaker. (Author/MSE)

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INTONATION AND TURN-TAKING IN GERMAN:

WOMEN VS. MEN

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The present study is an acoustic study of the F_o at sentence-, turn-, and discourse-end in conversation in German. While intonation has been shown to signal such discourse phenomena as sentence and paragraph boundaries (Lehiste 1977 & 1979 and Kreiman 1982), investigations of its role in turn-taking have not been as conclusive (e.g., perceptual tests by Schaffer 1983 showed great variability in how listeners use intonation to judge turn beginnings and turn ends). Results of an auditory study of German showed that terminal pitch and the degree of pitch change differ in sentence-, turn-, and discourse-end positions, providing some measure of support for the hypothesis that mid-falls in German (as opposed to low-falls) help to signal non-turn-ends or non-discourse-end. The data for the present study are short dialogues, each read 10 times by a male and a female native speaker of German, in which the same word occurs at the ends of utterances in the middle of a turn, at the end of a turn, and at the end of a discourse. Peak F_o, endpoint F_o, and the degree of the F_o fall are computed (using the L3 program for measuring the F_o of natural speech developed by William J. Poser at Stanford University). Results indicate that peak F_o's tend to vary greatly, while endpoint F_o's do not. Discourse-final F_o is characterized by a lower peak and a smaller degree of fall, but not by significantly lower F_o. In addition, the data show that the male speaker uses more sharply falling contours at turn-ends than the female speaker.

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INTONATION & TURN-TAKING IN GERMAN: WOMEN VS. MEN*

1. INTRODUCTION

Intonation signals a variety of discourse phenomena in English. In general, studies have shown that the intonational realization of a sentence cannot be predicted from its grammatical structure, and in many cases, it is determined by the discourse functions of the utterance. For example, sentence and paragraph boundaries are marked by low falling pitch or F_0 (fundamental frequency), pre-boundary lengthening, and pauses. In addition, intonation peaks in sentences are found to vary in height, marking the degree of "newness" or "disturbance of discourse flow," but endpoints tend to be more constant. The role of intonation in turn-taking, however, has not been investigated to as great an extent either in English or in German. One question, for example, is how intonation functions to signal that a speaker is willing to yield the speaking turn, i.e., to give up the floor and let another speaker have the floor.

In this paper, I first briefly give some background on previous research and then focus my attention on an acoustic study of German intonation. The immediate concerns here are threefold: 1) to determine whether there is a constant minimum or endpoint F_0 of statements in German, 2) to see whether terminal F_0 and the slope of falls at utterance-end, turn-end, and discourse-end differ significantly, and thus to test a hypothesis that

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mid-falls in German (as opposed to low-falls) help to signal that a turn or a discourse is not yet finished, and 3) to compare women's vs. men's intonation in turn-medial, turn-final, and discourse-final position. Simply put, is pitch a salient cue to signal the end of a turn, and do women and men use pitch in the same way? The ultimate goal is to develop a phonological model for discourse intonation in German, i.e., to describe, for example, the differences between sentence boundaries, paragraph boundaries, and the boundaries of conversational "turns," and to determine, for example, whether different degrees of falling F_0 are simply phonetic differences or variants predictable by rules, or whether they are in fact phonological differences.

2. PREVIOUS RESEARCH

In a series of studies on the phonological structure of paragraphs in English, Lehiste (1977 & 1979) found that 3 phonetic factors interact in providing paragraph boundary cues, but none of them is effective alone. These 3 factors are: 1) the length of the pause between utterances, 2) the presence of laryngealization (following a falling intonation contour which reaches the lowest level of the speaker's F_0 range), and 3) preboundary lengthening.

In studies by Boyce and Menn (1979) and Menn and Boyce (1982), fundamental frequency was also shown to play a role in "marking" discourse structure. Their main finding was that peak F_0 varies a great deal more than falling-contour endpoints. Peak height is chosen for discourse reasons, while endpoint values are chosen on the basis of intonation contour type and are more constant. In general, differences in peak F_0 of 2 adjacent utterances are related to the degree of "disturbance in discourse flow," e.g. higher peaks signal topic change or disagreement. Liberman and Pierrehumbert (1984) also found in their acoustic study that "the lowest F0 values, those of utterance-final falling accents, are nearly constant for a given speaker."

However, it must be noted that they were not looking at discourse-level phenomena.

The data from perceptual tests by Schaffer (1983) of the role of intonation as a cue to turn-taking proved somewhat inconclusive. There was a great deal of variability in how listeners used intonation to judge turn beginnings and turn ends. For example, rising F_o was the strongest cue of turn ends, but falling F_o was not especially effective as a turn-end cue, with or without laryngealization. High initial F_o was not found to mark turn beginnings consistently, and level F_o did not consistently signal turn continuation. In addition, the degree of F_o change did not seem to affect how turn ends and turn beginnings were judged.

In another perceptual experiment by Cutler and Pearson (1986), 10 speakers read short dialogues in which the same sentence occurred both turn-medially and turn-finally. The 200 utterances were presented singly in random order to 20 subjects, who judged each one as to whether it sounded turn-medial or turn-final. Turn-final judgments were associated low-falling F_o contours, while turn-medial judgments were associated with falling contours which did not fall as low. However, while F_o was found to be a major turn-taking cue, many of the utterances were found to be ambiguous, suggesting that other prosodic or voice quality features may also function as effective turn-holding or turn-yielding cues.

Since there had been very little done on turn-taking in German, I began with some preliminary auditory analyses of telephone conversations and panel discussions on television from a widely-used corpus of contemporary spoken German (Chun 1986). I found that slightly more than 50% of the turn-final utterances seemed to end on an intermediate level of pitch, i.e. a pitch in the middle of the normal range for a particular speaker; this is in marked contrast to the norm for English, where turn changes are said to be cued by a

trailing-off effect, i.e., both a drop to a very low pitch as well as a decrease in loudness (Lehiste 1979 and Kreiman 1982). It appeared thus that non-low pitches or contours occur in German at turn-end and serve as a turn-yielding cue.

Similarly, in a subsequent study of panel discussions on German television from the same corpus, I found that only slightly more than half of the utterances at turn-end (11 of 19 or 58%) exhibited a final contour which fell to a low pitch (Chun 1987). Accompanying these low-falling contours were always both a general fading of intensity and pitch as well as a pause. For the other half of the utterances (8 of 19 or 42%), the intonational contour at turn-end was characterized by either 1) a sustained contour at mid level or 2) a slightly falling pitch after the stressed syllable, which fell not to a low pitch, but rather to a mid pitch. In addition, pauses occurred at the end of the utterance, suggesting that the speaker was ready and willing to relinquish the floor. This corroborated the hypothesis of my previous study of German, i.e., that contrary to what has been found for English, non-low falling terminals in German can occur at turn-end. However, while it seems that more than one type of intonation can occur at the end of a speaker's turn --particularly when coupled with other features, such as pause or syntactic structure-- the various non-low contours serve the discoursal function of signalling that the speaker desires or expects a response of some kind. Of note in this case is that only one of these 8 utterances was an interrogative syntactically, i.e. had the inverted verb-subject word order of a yes-no question.

In addition, in both sets of data, there were even fewer low-falling contours at the ends of clauses and statements in the middle of turns. For example, in the first discussion, of a total of 78 declarative sentences, only 16 statements (21%) ended with a low-falling pitch; the remainder ended

with mid-falling or sustained contours. Similarly, at the ends of mid-sentence clauses, the majority of which were subordinate clauses, only 5 clauses out of 86 (6%) ended with a low-falling pitch, while the remainder ended with rising or sustained contours. This suggested support for the claim that intonation can serve to signal that a speaker is not ready or willing to relinquish the floor.

These preliminary findings needed to be tested and measured acoustically, and thus the present study was done.

3. THE PRESENT STUDY

In order to ascertain the characteristics of mid-falling contours in German and ultimately to test the notion that mid-falls might be phonologically distinct from low-falls in discourse, the following experiment was set up. Two short dialogues were written in which the same 3 words occur at the end of different utterances (see Appendix, Fig. 1 and 2). The three words are morgen 'morning' or 'tomorrow,' wiedersehen 'to see again' or 'goodbye,' and später 'later.' The utterances, in turn, occur in various positions in the 2 dialogues: in the middle of a turn, at the end of a turn, and at the end of the discourse (dialogue). These dialogues were read 10 times each by 2 native speakers of German, one female and one male, for a total of over 200 sentence tokens per speaker. F_0 measurements were then taken of the maximum and minimum F_0 points of each word and the degree of fall in F_0 over the word. The values for all 10 tokens of the same utterance were averaged, and the average F_0 values are plotted on the graphs in Fig. 3 and 4 in the Appendix.

In this pilot acoustic study of fundamental frequency, two different pitch-trackers were used. The female's speech was digitized in the Phonetics Laboratory at Stanford University on a VAX 11750, and pitch was tracked with

the "Corpitch" program (initially developed by Liberman then revised extensively by Poser). The F_o analyses were done on a Hewlett Packard mini-computer (9000/300), also known as the Bobcat, using Poser's "L3" software. The male's speech was digitized with a PDP-11 computer, and pitch was tracked on an FJ Electronics Real Time Pitch Computer. On both computers, readings for any point on the curves or F_o averages for any portion of the curves can be taken.

4. RESULTS

Three key F_o measurements were taken for each utterance: a) the peak F_o, i.e. the highest F_o reading for each test word; b) the endpoint F_o, i.e. the F_o at the end of each test word; and c) the degree of fall in each test word, i.e. the difference in Hz between the highest and lowest F_o values for each word. For each utterance, the average over all 10 tokens was computed (see Appendix, Figures 5-7 and Tables 1-3 below).

a. PEAK F_o. The individual peaks or maximum F_o's vary greatly across all of the test words and are the highest in turn-final utterances in both the woman's and the man's speech. In turn-medial and discourse final utterances, they also vary significantly, but not as much as in the turn-final utterances.

For the woman's turn-medial utterances, i.e. utterances (2), (5), (6), and (16), the range of variation is not insiginifcant. Peak F_o's range from 209.0 - 257.6 Hz, a difference of nearly 50 Hz. In discourse-final position, utterances (12) and (21), the range is also approximately 50 Hz. However, the range is much greater for the turn-final utterances (1), (11), (13), (14), (20): 199.2 - 297.8 Hz, a difference of nearly 100 Hz. The average peak height in turn-medial position is 241.4 Hz, in turn-final position 247.8

Hz, and in discourse-final position 225.1 Hz (see Table 1 below). These averages do not differ significantly across the different positions.

Table 1. PEAK (MAXIMUM) F_o OF TEST WORDS IN 3 POSITIONS.

	TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
FEMALE	241.4 Hz	247.8 Hz	225.1 Hz
MALE	123.6 Hz	171.1 Hz	132.2 Hz

For the man, there is also substantial variation in pitch peak: the average peaks in turn-medial position range from 82.8 - 164.4 Hz, a difference of over 80 Hz. In turn-final position, the range is from 92.3 - 216.4 Hz, an even greater difference of nearly 125 Hz. In discourse-final position, however, there is the least variation in peak height: the range is from 118.7 - 145.7 Hz, or a difference of only 27 Hz. The average peak F_o in turn-medial position is 123.6 Hz, in turn-final position 171.1 Hz, and in discourse-final position 132.2 Hz (see Table 1 above). In discourse-final position, there is overall fading of intensity and some laryngealization for both men and women.

b. ENDPOINT F_o. The average endpoint F_o values for the test words are in the range 164.7 - 176.4 Hz for the female speaker and 65.4 - 79.1 Hz for the male speaker, differences of 12 Hz and 14 Hz, respectively, which are not significant.

For the female, the endpoint F_o averages do not differ across the turn-medial, turn-final, or discourse-final positions. The average endpoint F_o for the words in the middle of a turn is 171.5 Hz. The average endpoint F_o for the words in both turn-final and discourse-final utterances is 170.1 Hz (see Table 2).

Table 2. AVERGAGE ENDPOINT F_o OF TEST WORDS IN 3 POSITIONS.

	TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
FEMALE	171.5 Hz	170.1 Hz	170.1 Hz
MALE	73.7 Hz	69.4 Hz	69.6 Hz

For the male speaker, his mean (average) endpoint F_o's are also fairly consistent: 73.7 Hz in turn-medial position, 69.4 Hz in turn-final position, and 69.6 Hz in discourse-final position. Wunderli (1979) found for his German data that F_o at paragraph-end is between 5 and 15% lower than at sentence-end. For the male speaker, the average F_o at discourse-end is 5% lower than in turn-medial position, but for the female speaker, the difference is less than 1%.

c. FALL IN F_o. The average difference in F_o, i.e. the average fall in F_o, does vary in the different positions and also varies between the male and female speakers. For the female speaker, the average fall in F_o in turn-medial position is 69.9 Hz, in turn-final position 77.3 Hz, and in discourse-final position 56.1 Hz. For the male speaker, the average fall in F_o in turn-medial position is 49.9 Hz, in turn-final position 101.6 Hz, and in discourse-final position 62.2 Hz.

Table 3. AVERAGE FALL IN F_o IN TEST WORDS IN 3 POSITIONS.

	TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
FEMALE	69.9 Hz	77.3 Hz	56.1 Hz
MALE	49.9 Hz	101.6 Hz	62.2 Hz

Wunderli (1979) found that the F_o interval of the fall at paragraph-end

is 20% larger than at sentence-end. In my data, for the woman, the fall in F_o is only 10% greater at turn-end than in turn-medial position, but smaller at discourse-end than in either turn-medial or turn-final position. For the man, the fall in F_o is 100% greater at turn-end than in turn-medial position. In discourse-final position, the fall is 25% greater than in turn-medial position. One also notes that the word wiedersehen 'good-bye' has the greatest interval of F_o fall for both the woman and the man: a possible explanation is that the longer the word, the greater the pitch range within which the F_o can fall.

5. DISCUSSION

a. PEAK F_o. The data support Boyce and Menn's claim that "peaks vary, endpoints do not." Peaks are said to vary in order to signal or mark discourse structure. (In analyzing the wide variation in the peaks, it is helpful to look at the graphs in Figures 3 and 4 in the Appendix.)

For the female speaker, it is interesting that the two words which are "responsible" for the wide variation in pitch peaks are both contained in the leave-taking expressions, auf wiedersehen 'good-bye' and bis später 'until later.' With auf wiedersehen, a very high pitch is used consistently, while with bis später, a lower than usual pitch is always used. This can be explained pragmatically: the very high F_o peak for utterance (11) Auf Wiedersehen could be interpreted as marking a topic shift, the beginning of the leave-taking ritual. In contrast, very low F_o peaks (and fading intensity) are found for (20) and (21) bis später, which are the final two utterances in the second dialogue. Since the utterances occur at the very end of the "task" for the two speakers, their low peaks mark discourse-final lowering. Similarly, for utterance (2) Morgen 'morning' low F_o peaks occur, as the utterance is an "echo" response to the first speaker's greeting.

The male speaker's peak F_o averages are somewhat different from the female's, but similar pragmatic explanations can be offered. The peaks in the first utterance of each dialogue (1) and (13) are the highest of all utterances. Directly parallel to the woman, a high peak is found with utterance (11) Auf Wiedersehen, and low peaks (as well as laryngealization) are used with the last two utterances (20) and (21) of the second dialogue. Unlike the woman, the man does not stress the words morgen 'tomorrow' and später 'later' in utterances (5) and (16); thus very low peaks (and fading intensity) are used since these words occurred at utterance-end. One notes, contrary to my original hypothesis, that these very low peaks occur in turn-medial utterances.

b. ENDPOINT F_o. These F_o measurements also confirm Boyce and Menn's study of English which found constant endpoint F_o's, but they do not bear out my hypothesis that mid-falls are used to signal that a turn is not over. Both the male and the female show comparable consistency in endpoint F_o's, without a significant difference between discourse-final F_o and non-discourse-final F_o. Further investigation, e.g., of data in the corpus of contemporary spoken German, as well as perception studies, are needed.

c. FALL IN F_o. Since the peaks vary and the endpoints remain relatively constant, the fall or change in F_o is in direct correlation to the variation in peak F_o. Two observations can be made here. First, discourse-final words are marked, not with lower endpoint F_o, but with lower peak F_o and a smaller fall in F_o. Second, the sharp falls used by the male in turn-final utterances are somewhat striking because previous studies, e.g. Takefuta et al. (1972) and McConnell-Ginet (1975), suggested that women use more frequent and sharper shifts in pitch than men; women are said to use a wider range of pitch and more "dynamic" intonational patterns. However, while the sharper falls may signal a notion of greater "finality" --males are said to use more

decisive and assertive intonation (see Terrango 1966, Brend 1975, and Aronovitch 1976)-- the utterances in which they are used are the greeting and leave-taking formulas ('morning' and 'good-bye'). Since the male speaker had had informal training in acting, this is a possible reason for his more "dynamic" intonation.

One of the greatest limitations of the pilot study is that the greetings and leave-taking expressions are formulaic utterances and as such may have formulaic intonations of their own, different from "normal" sentence intonation. In a future study, non-formulaic utterances will be used. The same sentence will be used as a test sentence (instead of single words), and the entire sentence will be placed in varying positions: in turn-medial, turn-final, and discourse-final position.

6. CONCLUSION

While these results are not definitive, they do suggest that differences in fundamental frequency, particularly with regard to the height of the peaks and the interval of the fall, do exist in different positions in the discourse. At turn-ends, peaks seem to be higher and, at least for the male, falls tend to be sharper. At discourse-end, peaks tend to be lower and the degree of fall smaller. On the other hand, my hypothesis based on previous auditory analyses was not borne out: endpoints do tend to be within a small range of F_0 for each speaker, and there is no apparent difference between low-falls and mid-falls which would signal turn-ends vs. non-turn-ends.

Further and more extensive study is obviously needed. In particular, acoustic measurements of F_0 in the natural data which have only been analyzed auditorily must first be taken. Second, perceptual studies must be done, preferably also with filtered speech and/or synthesized speech (perhaps using nonsense syllables) to test how the various falls are judged by listeners. By

varying the degree of fall and the lowest pitch of the fall with synthesized speech, we can try and determine whether there are distinct "tunes" in German, e.g. mid-falls and low-falls. In other words, if hearers consistently perceive certain pitch intervals or levels as having distinct meanings, then these "tunes" or "tonemes" might be phonemic in German. If listeners <u>are</u> able to do this, this would lead in turn to the question of at what level the various "tunes" are distinctive, i.e., at the sentence level or only at the discourse level.

Third, two other variables, pre-boundary duration and length of pause between utterances must also be tested acoustically for my German data. These variables have been shown to play a role in English in marking sentence boundaries, paragraph boundaries, and turn boundaries. Lehiste (1979:107) found the duration of pauses between utterances to be "the one dependable cue" to turn-end. For German, Wunderli (1979) also found that pause length is the most important parameter for the differentiation of sentence vs. paragraph ends. Intensity is the second most important feature, and F_0 only third most.

In conclusion, let me echo the suggestions of Cutler & Pearson (1986:153), two of the leading researchers of intonation in discourse. They recommend "the following combination of methodologies for a definitive investigation of prosodic cues to turn-taking: (a) analysis of natural conversation to answer the production question by establishing a repertoire of features characteristic of turn-final and turn-medial utterances respectively; (b) use of speech resynthesis techniques to impose each of these sets of features on otherwise identical utterances, thus creating a range of carefully controlled stimuli which would allow one to ask not only whether a given feature was an effective cue, but which cues were relatively more and which relatively less important" to answer the perception question.

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APPENDIX

Figure 1. DIALOGUE 1.

A: (1) Morgen. ('Morning.')

B: (2) Morgen. (3) Ist dein Bruder schon hier?
('Morning. Is your brother here yet?')

A: (4) Nein, er ist noch nicht hier. (5) Ich sehe ihn morgen.
(6) Morgen werden wir uns wiedersehen. (7) Ich habe
ihn seit einem ganzen Jahr nicht mehr gesehen.
('No, he's not here yet. I'll see him tomorrow.
Tomorrow we'll see each other again. I haven't
seen him for a whole year.')

B: (8) Wie schön. (9) Sag ihm schöne Grüße von mir.
('How nice. Say hello to him for me.')

A: (10) Die werde ich ausrichten. (11) Auf Wiedersehen.
('I'll tell him. Good bye.')

B: (12) Auf Wiedersehen. ('Good bye.')

Figure 2. DIALOGUE 2.

A: (13) Guten Morgen. ('Good morning.')

B: (14) Guten Morgen. ('Good morning.')

A: (15) Hast du deinen Bruder gesehen?
('Have you seen your brother?')

B: (16) Nein, aber ich sehe ihn später. (17) Er wohnt nämlich bei mir.
(18) Ich könnte ihm etwas ausrichten.
('No, but I'll see him later. He lives with me.
I could give him a message.')

A: (19) Nein, danke. (20) Also, bis später.
('No thanks. Well, until later.')

B: (21) Ja, bis später. ('Yes, until later.')

Figure 3. GRAPH FOR AVERAGE F_o READINGS FOR FEMALE SPEAKER.

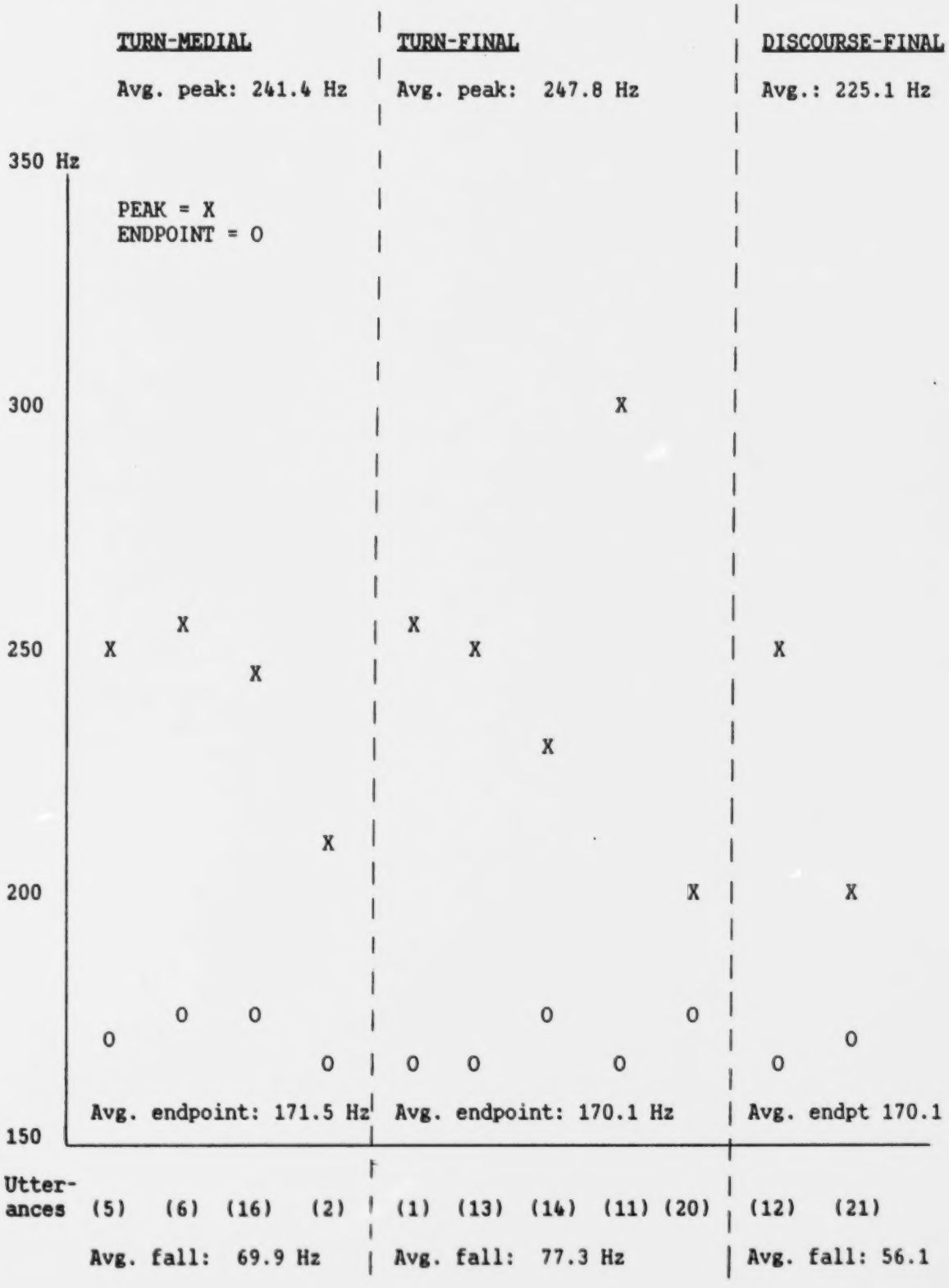

Figure 4. GRAPH FOR AVERAGE F_o READINGS FOR MALE SPEAKER.

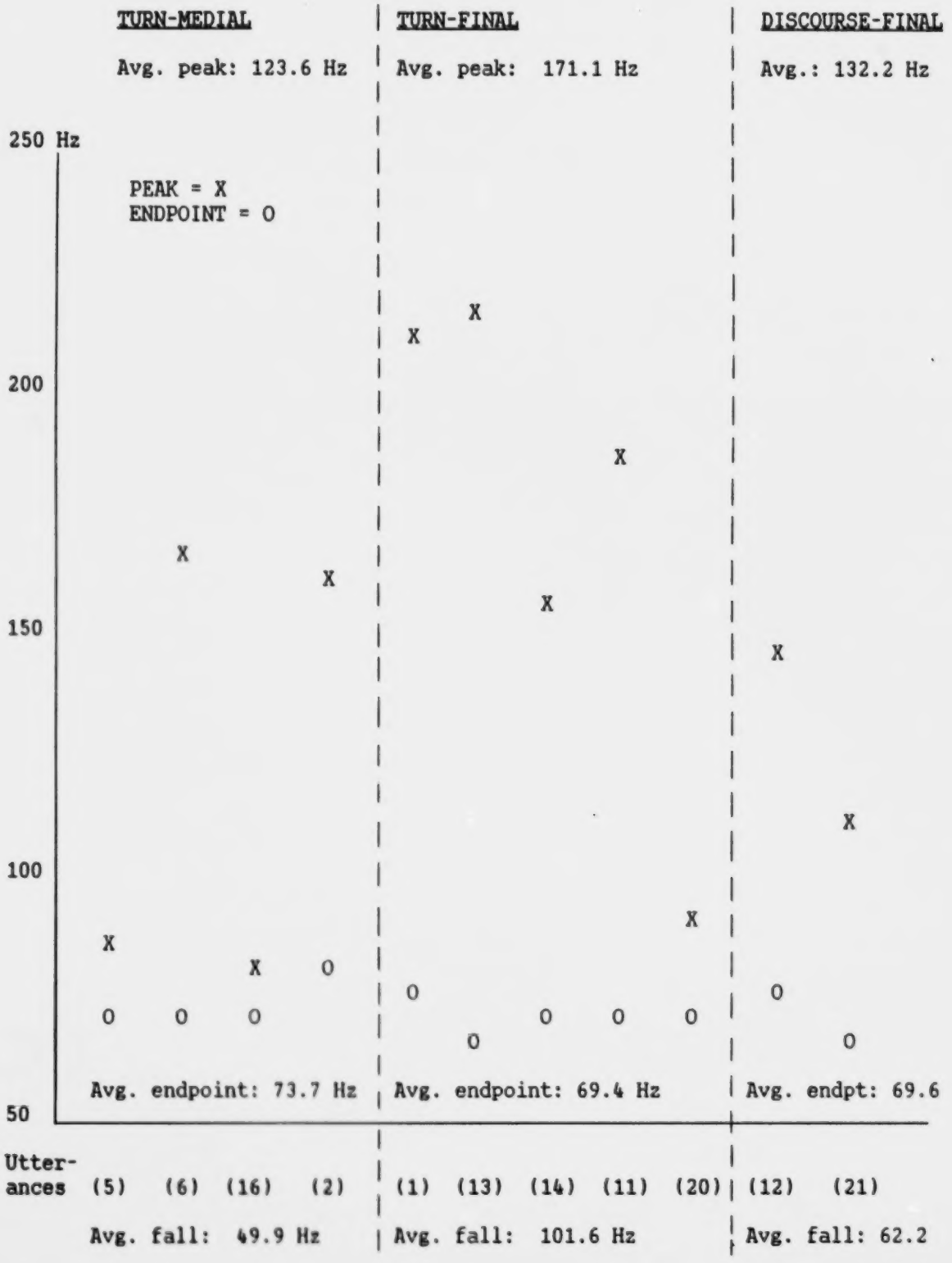

Figure 5a. AVERAGE PEAK F_o FOR THE FEMALE SPEAKER.

TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
209.0 Hz morgen (2)	256.2 Hz morgen (1)	
251.6 Hz morgen (5)	252.7 Hz morgen (13)	
	233.1 Hz morgen (14)	
257.6 Hz wiedersehen (6)	297.8 Hz wiedersehen (11)	249.7 Hz w'sehen (12)
247.5 Hz später (16)	199.2 Hz später (20)	200.4 Hz später (21)
241.4 Hz AVERAGE	247.8 Hz AVERAGE	225.1 Hz AVERAGE

Figure 5b. AVERAGE PEAK F_o FOR THE MALE SPEAKER.

TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
160.1 Hz morgen (2)	208.7 Hz morgen (1)	
87.0 Hz morgen (5)	216.4 Hz morgen (13)	
	154.1 Hz morgen (14)	
164.4 Hz wiedersehen (6)	183.8 Hz wiedersehen (11)	145.7 Hz w'sehen (12)
82.8 Hz später (16)	92.3 Hz später (20)	118.7 Hz später (21)
123.6 Hz AVERAGE	171.1 Hz AVERAGE	132.2 Hz AVERAGE

Table 6a. AVERAGE ENDPOINT F_o FOR THE FEMALE SPEAKER.

TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
164.7 Hz morgen (2)	167.6 Hz morgen (1)	
171.1 Hz morgen (5)	167.5 Hz morgen (13)	
	173.8 Hz morgen (14)	
173.7 Hz wiedersehen (6)	167.1 Hz wiedersehen (11)	167.5 Hz w'sehen (12)
176.4 Hz später (16)	174.7 Hz später (20)	172.6 Hz später (21)
171.5 Hz AVERAGE	171.5 Hz AVERAGE	170.1 Hz AVERAGE

Table 6b. AVERAGE ENDPOINT F_o FOR THE MALE SPEAKER.

TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
79.1 Hz morgen (2)	73.2 Hz morgen (1)	
71.3 Hz morgen (5)	66.9 Hz morgen (13)	
	69.4 Hz morgen (14)	
71.5 Hz wiedersehen (6)	67.7 Hz wiedersehen (11)	74.6 Hz w'sehen (12)
72.7 Hz später (16)	69.9 Hz später (20)	65.4 Hz später (21)
73.7 Hz AVERAGE	69.4 Hz AVERAGE	69.6 Hz AVERAGE

Table 7a. AVERAGE CHANGE IN F_o (FALL) FOR THE FEMALE SPEAKER.

TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
44.3 Hz morgen (2)	88.5 Hz morgen (1)	
80.4 Hz morgen (5)	85.2 Hz morgen (13)	
	59.3 Hz morgen (14)	
83.9 Hz wiedersehen (6)	130.7 Hz wiedersehen (11)	84.7 Hz w'sehen (12)
71.1 Hz später (16)	20.0 Hz später (20)	27.4 Hz später (21)
69.9 Hz AVERAGE	77.3 Hz AVERAGE	56.1 Hz AVERAGE

Table 7b. AVERAGE CHANGE IN F_o (FALL) FOR THE MALE SPEAKER.

TURN-MEDIAL:	TURN-FINAL:	DISCOURSE-FINAL:
81.0 Hz morgen (2)	135.5 Hz morgen (1)	
15.7 Hz morgen (5)	149.5 Hz morgen (13)	
	84.7 Hz morgen (14)	
92.9 Hz wiedersehen (6)	116.1 Hz wiedersehen (11)	71.1 Hz w'sehen (12)
10.1 Hz später (16)	22.4 Hz später (20)	53.3 Hz später (21)
49.9 Hz AVERAGE	101.6 Hz AVERAGE	62.2 Hz AVERAGE

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